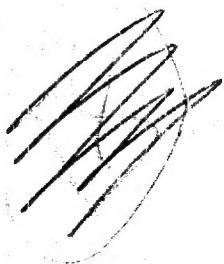


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SCIENTIFIC INTELLIGENCE

A Lecture Delivered in the Junior Officer Training Program

by

Dr. Herbert Scoville

Assistant Director

Office of Scientific Intelligence

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Intelligence School

OFFICE OF TRAINING

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~~CONFIDENTIAL~~INTRODUCTION: Scientific Intelligence

In war or in times of tension, new discoveries of science are promptly translated into weapons or weapon systems, usually before the peaceful applications have been exploited. Thus, from the laboratory demonstration that fission was possible, the Manhattan Project developed and produced the first atom bomb in 1945. The use of the V-2 missile against England during the latter part of the war proved the possibility of a super-sonic missile. Within fifteen years, the ICBM was a reality. In the present time of tensions, new and secret weapons may be now on the drawing boards.

It is the task of scientific intelligence, in so far as possible, to predict what new weapons are now being developed by foreign nations, to devise scientific means for learning about these developments-- checking on missile-testing ranges for example--, and to report on the characteristics of the weapons while they are still in the prototype stage. It is the constant apprehension of the United States that the Soviets may arrive at a "break-through" in science that could give them a significant advantage over the United States. The Office of Scientific Intelligence is entrusted with making the proper interpretations of the data supplied them so the U. S. will be constantly aware of new developments and hence capable of countering them.

The responsibility is a very heavy one because by "weapons" is meant all forms of offense stemming from the discoveries of science that may be of serious damage to the United States: biological warfare, chemical warfare, the development of new drugs, or the means of

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conditioning men or changing their habits of thinking. OSI's responsibility covers most of the fields of science; hopefully, however, the knowledge gained may have implicit in it the power of prediction--of revealing to the trained scientific intelligence officer an outcome still far on the horizon.

Dr. Scoville discusses the problems facing the Office of Scientific Intelligence and explains how it is organized to solve them. He is at present Assistant Director of OSI; previously, he served as Senior Scientist with AEC and before coming to CIA was Technical Director of the Armed Forces Special Weapons Project.

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SCIENTIFIC INTELLIGENCE

IMPORTANCE OF SCIENTIFIC INTELLIGENCE TO THE U.S.

LAUNCHING OF SOVIET SATELLITE PREDICTED

THE NEED FOR FACTUAL INFORMATION

Priority of Missile Intelligence

Current Intelligence on Soviet Missile Test Firings

ORGANIZATION OF OSI

Deputy Assistant Director For Collection

Guidance For Collectors

Collectors Without Scientific Background

Methods of Determining Soviet Production of Fissionable Materials

Deputy Assistant Director For Production

Physical Science Division

Analysis of Soviet Capabilities in Basic Science

Study of Soviet Organization for Research

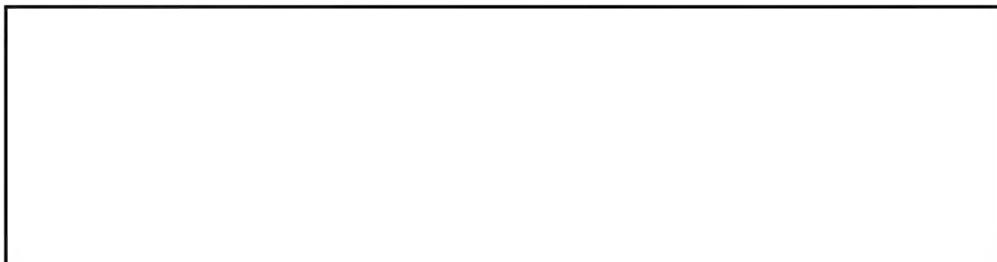
Life Science Division

Space Medicine

Radio-Biology and Atomic Medicine

Nuclear Energy Division

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Guided Missile Division

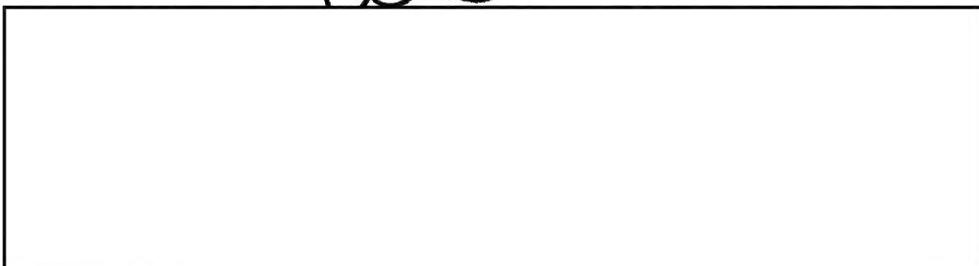
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Electronics Division

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Applied Science Division

Study of New Developments

Biological Warfare and Chemical Warfare

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SCIENTIFIC INTELLIGENCE

(JOT lecture delivered by Dr. Herbert Scoville)

I'm very glad to be able to talk to you about scientific intelligence, because I'd like to give you a little sales talk. While I'm not a salesman, I enjoy selling this product. I think today that scientific intelligence is of such paramount importance that it is a very easy thing to sell. It is not only my feeling in this respect; I think that this is really the feeling on all the top levels of Government.

IMPORTANCE OF SCIENTIFIC INTELLIGENCE TO THE U.S.

An example of the importance that has been attached to scientific intelligence is the fact that in early 1956 when the President was establishing his Board of Consultants on Foreign Intelligence Activities, he selected as his chairman of that Board Dr. James R. Killian, who had had considerable experience in the scientific aspects of intelligence. I think that this exemplified the tremendous interest that high level people have in this general subject. Dr. Killian, of course, is no longer the chairman of that Board. When he became

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the President's adviser on science he had to relinquish his chairmanship. <sup>1/</sup> But we still have very strong support for scientific intelligence from the highest levels in Government. Actually, I don't believe any one subject has had more influence on our national policy decisions in recent months than scientific intelligence.

During the past few years, scientific intelligence matters have played the most important part in major decisions of the National Security Council with the possible exceptions of the crises in China and the Near East. Even prior to Sputnik I there was tremendous interest in this whole field. If there were any people who doubted its importance after Sputnik I, their doubts were dispelled completely.

LAUNCHING OF SOVIET SATELLITE PREDICTED

For a period of about one year prior to the launching of that first Soviet earth satellite, we had repeatedly predicted that the Soviets would launch such a satellite. To some extent this prediction was based upon our knowledge of the Soviets' general scientific capabilities and on what we knew from intelligence sources of what they were doing in the missile field. On the other hand, we had no specific reports stating that they had a vehicle ready and that they were going to launch a satellite on a particular date. We thought originally that

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<sup>1/</sup> Dr. George Kistiakowsky is now the chairman of the President's Scientific Advisory Committee. Like Dr. Killian, he has had a close connection with U.S. intelligence activities.

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they might do it at the end of 1957 or early in 1958 at the very beginning of the International Geophysical Year. There was, however, no firm evidence to give backing to this belief. But as the summer wore on and we received more and more little bits of indications, public statements, [redacted] and similar things, we were led to believe that the launching of a satellite was imminent and might occur at any time.

We put these beliefs into the National Intelligence Estimates, the Scientific Intelligence Digest and into the Current Intelligence Digest, but we had no really hard facts to go on. As a consequence, I regret to say that a lot of these predictions went in one ear and out the other. And while people said, "Yes, they predict it's going to happen," I don't think anybody realized, or felt down deep, that it actually was going to happen. Here was a case where we had the right estimates, but were not able to get that estimate across in a sufficiently forceful form so that people would make the policy decisions that were necessary to be made. So when Sputnik I was launched it turned out to be a tremendous shock, not only to the people of the country, but to all levels of Government.

#### THE NEED FOR FACTUAL INFORMATION

I quote this as an example of where we guessed right, but still did not succeed. We have got to do a better job of getting our product across so that it can be acted upon. One of the most important things in selling a given intelligence item is to have some facts. If you have some actual data to go on, then you're going to get better

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credibility for the point you're putting across.

That is not the only reason we want facts. We need facts in order to make better judgments in the first place. In many respects we are very, very poor in terms of the factual material that we have available. Take the missile field today as an example. This is one in which we have relatively good intelligence in comparison to that in many other fields. We are able to follow the Soviet missile tests quite consistently, at least their ballistic missile test program. We know when they have fired a shot by a combination of a number of scientific intelligence techniques, but we know almost nothing about the production of missiles or their deployment. These are really key items in trying to estimate and to figure out exactly the Soviet capability for attacking this country.

Priority of Missile Intelligence

The whole subject of missile intelligence is probably the single, most important intelligence item that exists in the country today. It has the highest priority in every document that comes along. It is right at the top of the first priority of the Priority National Intelligence Objectives. It is the one item that gets pushed up immediately to the highest levels of Government whenever we have any useful information concerning it. In fact, one of the headaches of our Office these past years has been this tremendous interest in spot information on missiles.

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Current Intelligence on Soviet Missile Test Firings

Current intelligence on Soviet missile test firings is very important. Whenever we get any indication that there is going to be a missile firing, the Guided Missiles and Astronautic Intelligence Committee (GMAIC) of our guided missile ~~start working around the clock~~ gets called together. They look over all the data as fast as it comes in on the cables; on many occasions they ~~work~~ <sup>work</sup> all night long. As far as OSI, our particular Office is concerned, these firings are a headache, because we are practically the only sizeable group that is actually handling missile intelligence in the Washington area. Although the Air Force has a very big group, it is so far away from Washington that it can't supply the spot analysis that has to be done. Consequently, our Office has had to devote a very large fraction of effort in the missile field to the handling of these spot items. Now, we don't object to doing this; we feel that it is a useful function. It does, however, interfere with the longer range type of analysis that is needed to predict something well ahead of when it's going to happen, rather than just ten minutes before. We have had to increase the size of our guided missile effort in order to handle these day-to-day spot items as well as the longer range problems.

ORGANIZATION OF OSI

I can't emphasize too much the importance of having actual facts upon which to base our intelligence estimates. So we, as an Office, put quite a lot of effort into trying to think of ways in which methods of collecting factual intelligence in the scientific field can be improved. I shall tell you here how we have organized our Office in order

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to tackle this problem. The Office is primarily a production office. In other words, we do not have any responsibility for collecting information, as such. That's the responsibility of the Deputy Director for Plans (DD/P) or the Office of Operations (OO), which has overt collection responsibility. Because we felt, however, that this business of improving collection is such an important item that the real gains in scientific intelligence are going to occur when we get more facts, we have divided the Office into two parts. I have two deputies, a Deputy Assistant Director for Collection and a Deputy Assistant Director for Production. Then we have two staffs, the Collection Staff and the Production Staff that do the staff work for those two parts of the shop.

Deputy Assistant Director for Collection

Guidance for Collectors: Now, the Deputy Assistant Director for Collection does not carry out any collection activities, as such, but he and the Collection Staff work very closely with all the collectors in the community to try to improve the guidance and assistance that can be given to the people who do collect information. This assistance goes far beyond formalized or general requirements. It gets down to detailed guidance. We try to help a person who is running a collection asset by advising him of the specific information that's wanted so he can instruct his asset accordingly and thus avoid the collection of a lot of useless information. This specific guidance is important in the scientific field because you can't expect every case officer or every agent to be a scientist himself. Nor is it really necessary that he should be.

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Collectors Without Scientific Background: It's very useful to have for collectors, people who have scientific backgrounds, but you do not have to be a scientist in order to collect useful scientific intelligence. An example of the kind of scientific intelligence that is extremely useful, the collection of which requires no scientific background whatsoever, has to do with our getting at the production of Soviet fissionable material.

Obviously, the size of the Soviet nuclear stockpile is an intelligence item of overriding importance. It determines the Soviets' over-all capabilities not only to wage an attack against this country, but also to conduct tactical warfare, or possibly to use nuclear weapons for air defense. The fissionable material production problem is particularly important in this last instance because you have to have large quantities of fissionable materials if you're going to use them for air defense purposes. Now, how does one go about getting this information? It's

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So you have to deduce this type of thing by secondary means. One key factor in determining the rate of production of Uranium 235, which is one of the primary fissionable materials,

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As a result of a combination of intelligence activities over a period of years, we have succeeded in establishing where, we believe, a number of their major fissionable materials production sites are located. I say, "where we believe," because we may have missed some. Every now

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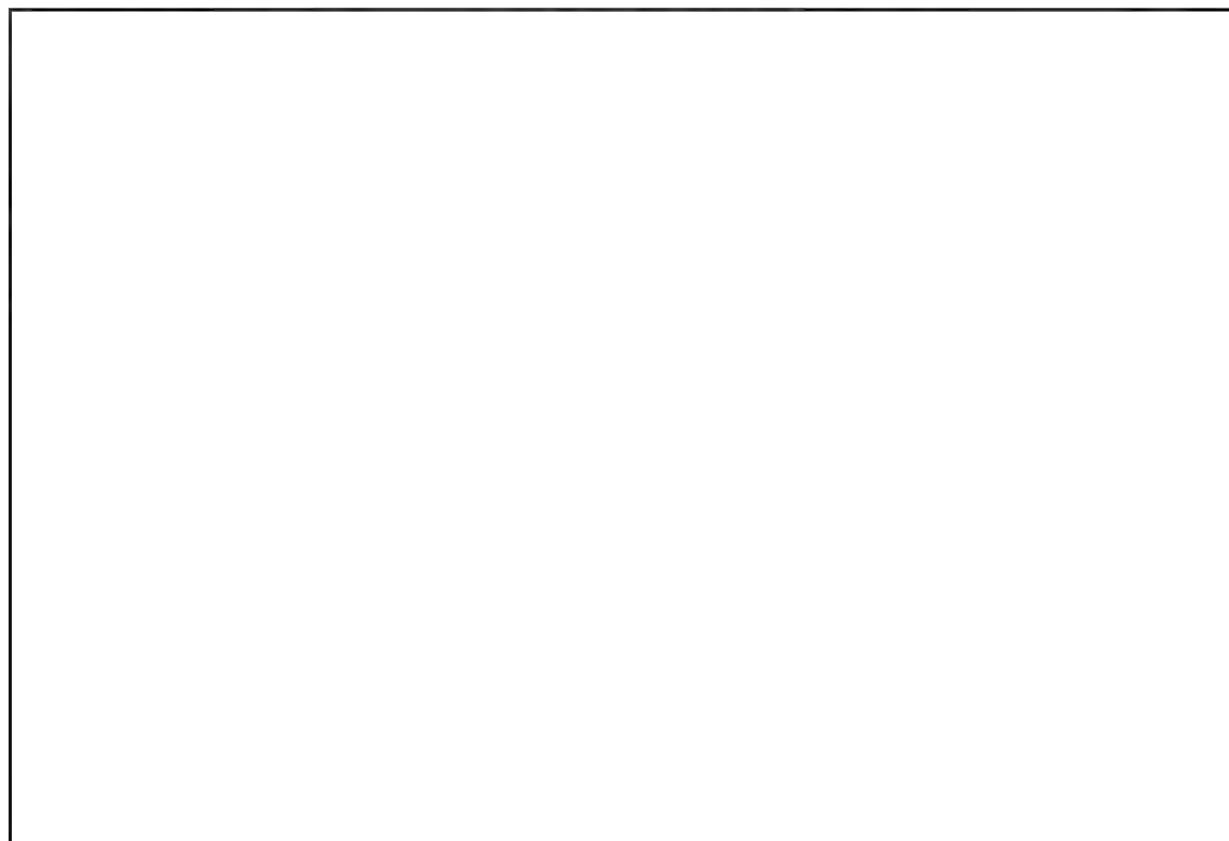
and then we find out something that we had no idea about before. But, as far as Uranium 235 is concerned, we now believe that they have a major production site at Verknievinsk. In addition to that we believe that they have another major production site at Tomsk.

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make what we believe to be a reasonable estimate of the Uranium 235 production in the Soviet Union.

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I just quote this as an example, a very good example, of what you can do by just working at little pieces of the problem, not necessarily requiring any scientific training. It's true, though, that scientific training was needed

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[redacted] You had to have people who were very cognizant of this problem, but there was no difficulty in this. We either supplied people from our own Office here in OSI, or, in a number of cases, we got people from the Atomic Energy Commission who had actually been

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involved in developing our own gaseous diffusion plants, and the

[redacted] This efficiency information

is now out of date, and all we can do until we get some more is to

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extrapolate on a reasonable curve as to how fast they are improving their processes. Production of Uranium 235 in the U.S.S.R. is still a very important intelligence item. I haven't got a good suggestion as to how you get at the efficiency today, but we're looking for bright ideas.

Deputy Assistant Director for Production

As I mentioned, we have two sides to the Office. One is the collection side, which doesn't do the collection but provides the guidance for collectors. The other side, production, takes all information that we collect from all sources and pieces it together. It then puts out the material in various forms for publication. Our finished product comes out in the form of estimates; some of it is published as Scientific Intelligence Reports; items of current importance appear fairly regularly in the <sup>CENTRAL</sup> Current Intelligence Bulletin of the Office of Current Intelligence (OCI); and then there are Research Aids and other publications. In addition, every two weeks we put out the Scientific Intelligence Digest, which consists of a series of current items that are of more interest to scientific intelligence officers than to the general intelligence officer.

Physical Science Division

Analysis of Soviet Capabilities in Basic Science: We have six substantive divisions, the first of these being the Physical Science Division. The work of this division is to keep track of Soviet capabilities in the basic scientific fields, such as physics, chemistry, and mathematics. The work of this division provides a lot of background material for estimating where the Soviets can go, in maybe three to five

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years from now. Since you can't keep track of every single item in every scientific field, we try to key the specific projects in the Physical Science division to fields that we think may have important military or political interests in years to come. For example, we keep track of work on superfuels for airplanes or missiles that may be of immense value in eventual developments by the Soviets.

Study of Soviet Manpower: The other main function of this division, which has proved extremely valuable in the past few years, has been to keep a watch over Soviet scientific manpower; that is, not only the numbers of people (I think that's pretty well under control at the present time) but also, what is very much more difficult, the quality of Soviet scientific manpower and of Soviet education. I think that you have all seen many a critical article about the sorry state of our own scientific education. It may be a poor way to have to justify improvements in U.S. education, but one of the chief instruments in stirring up people to get going in our own scientific education problems has been to point out how well the Soviets are doing. It just seems to be a fact of life that the people of this country get more excited when they think that the Soviets are doing something which we are not.

The division has produced all of the material that is being used by Government speakers all around the country in discussions of Soviet scientific manpower. Most of this information is unclassified; it doesn't come from sensitive sources and it can be published. I myself give lectures on this subject from time to time because I think we can perform a very useful and helpful function by them. The hardest problem

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is finding a means of getting at the quality of Soviet education. The numbers are relatively easy, but the quality is much more difficult and one that we are working on as hard as we can.

Study of Soviet Organization for Research: Another related subject is, how do the Soviets organize in order to conduct their research and development? We are increasingly impressed with the relatively short time, efficient time, that goes into their development cycle. We, unfortunately, seem to get involved in a myriad of committees, subcommittees, and other reviewing groups, that review every project that comes along so that it takes years for us to really get started on a research and development project, unless it's so obviously important that you can skip some of this arguing. We are interested in studying the Soviet situation to see if we can learn anything from them in this respect.

I might say that the general interest in basic science is somewhat surprising. All of the top levels of Government are very much interested in this particular subject. I happened to be at a high level Government meeting immediately after the Russians had launched their first Sputnik, and I thought the whole conversation was going to be on missiles and satellites, and so on. Strangely enough, the conversation took a completely different turn and got down to the problem of how good the Soviets were in basic research, and what this portended for the long-range future. So, even at the highest Government levels, with people who are interested in day-to-day critical problems, and at that particular critical time, they were worrying about the capabilities of the Soviets in fundamental research. And with very good reason, but it's nevertheless

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Control Processes: A high priority area of work in the Life Sciences Division has been a Soviet research on control processes in machines and in living things. This well-coordinated Soviet research is done under the Cybernetics Council of scientists in many disciplines, such as mathematics, physics, and biology, and has many possible important implications for the future in such areas as the Soviet economy and in international political and social relationships. Most of our intelligence effort so far has been carried out by a DD/P Task Force headed by [redacted] Chief, LSD

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surprising and gratifying that this is true. The Physical Science Division, incidentally, is quite large because it has to cover so many fields.

It has about

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Life Science Division

We also have a Life Science Division. This is much smaller than the others.

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Space Medicine: The main problems that this division has been working on, particularly in the last couple of years, deal with space medicine. We developed an interest in space medicine; well before Sputnik I and have turned up a good deal of useful information on this subject during recent years. This information has been valuable in providing help and guidance to the people who are developing our space program. Originally, the small task force of the President's Science Advisory Committee working on our space program was inclined to dismiss space medicine as an unimportant factor. Among the programs in space medicine or space biology submitted to them, the task force had not found one that it thought worthy of support. We just happened to dig up some information on the Soviets' astro-biology program started, incidentally, back in 1955. The Soviets established a scientific institute that had really high level people in it to work first on the subject of astro-biology and astro-botany, that is, the plant life that might exist in various space environments. We had fairly detailed information on this program, as outlined by the Russians themselves over the past year and a half. When we showed it to the people preparing our own program, they

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immediately revised their plans and got hold of some good people who came up with a reasonable program of our own. Now, these people were not just going into this space program because they thought the Russians had one. They were going into it because they thought that the program was a good one. This particular piece of intelligence helped to spark some really constructive U.S. thinking in this field.

Radio-Biology and Nuclear Medicine: In the Life Science Division we also are studying Soviet researches in radio-biology and nuclear medicine, which are, of course, of considerable significance to our understanding of the Soviets' preparedness to withstand attack with mass-destruction weapons. There are many other aspects of medicine which are also studied but which I will not describe in detail here.

Nuclear Energy Division

Another component of OSI is the Nuclear Energy Division. This division handles all of the material supplying information on the Soviets' atomic weapons developments and peaceful developments as well.

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acts as the center for the whole community in this field. It has been  
relatively quiet in the weapons field recently as a result of the Soviet

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[Redacted]

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This program, though, goes a lot farther than just finding out that

[Redacted] It is a classic example of how to collect scientific

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information, [Redacted]

[Redacted]

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only develop similar techniques in other fields, I'm sure our life  
would be much easier and we'd be smiling much more often than we do.

Location of Plants Producing Fissionable Materials: I have already  
mentioned the problem of getting after Soviet production of Uranium 235.  
This is a task in which our Office plays a major role, in fact a leading  
role. We also have programs that try to get at Soviet plutonium pro-  
duction, the other major fissionable material. These programs have been  
partially successful; we have located various plants where we believe  
the Soviets are producing plutonium. In fact, as a consequence of about  
ten years of intensive effort, we have a pretty good idea where the major  
installations are in the Soviet atomic energy program. This problem of

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locating plants doesn't, by itself, provide you with any intelligence, but it is certainly one of the main stepping stones in getting started on the problem. It is this kind of information that is extremely useful in piecing together the over-all picture of the Soviet program. I want to point out some of the successes that have been achieved.

I mentioned the two sites where the Soviets are producing Uranium

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Intelligence Value of International Conferences: I would like to emphasize that [redacted] conference is a good example of a major source for increasing our knowledge. You do not generally get very highly classified information from these international conferences. But

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probably an ideal example. Still, there are a surprisingly large number of conferences throughout the world to which Soviet scientists do come,

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[redacted]

them had been successful. The other three had drawn completely negative reactions, the Soviets had ignored them completely, would not discuss anything with them that was at all interesting. One American, however,

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had got into a very interesting conversation.

[redacted]

more the Soviets have been attending scientific conferences and thus providing us with a real opportunity to get in close touch with them. Recently, I had the opportunity to attend one of these conferences myself. It was a little different from the normal scientific conference; this was the Geneva conference on test cessation which went on for two months at Geneva during 1958. I went there openly. Since everybody knows that I work for CIA, there was no concealment. I didn't wear a button with CIA on it, but the Soviets obviously knew. In fact, I had an interesting experience. At one of the receptions, a Soviet foreign office type came up to me and very cordially said, "Where do you work? Do you work in New York?" I said, "No, I work in Washington." Continuing, he asked, "Is this the first time you ever met a Soviet scientist face to face?" I replied, "Yes," and he said, "Well, has it changed your opinion of Soviet scientists?" I answered, "No, I don't think it has very much." We carried on a conversation for a little while and then parted in an apparently friendly way. But, the point is that he had obviously approached me with the idea of letting me know that he knew where I worked. This produced no embarrassment whatever.

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[redacted] to meet with the Soviets in groups. I didn't meet with them privately as that was not my job. It certainly was a very useful opportunity to get a firsthand evaluation of these people. [redacted] were not

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necessarily outstanding scientists. One of them, though, [redacted] is a

[redacted] but he turned out

to be a complete failure. He was a sour individual. He may have been a good scientist ten years ago but he's over the hill now and is much more interested in politics. He didn't catch on to things very well. He missed the point, was very dogmatic in his approaches to problems, and very proud. Some of the lesser lights who were there were very competent, very pleasant, and there was no feeling of tension among us at all.

U.S. Interest in Soviet Peaceful Uses of Nuclear Energy: I would like to say that we're interested not only in the Soviets' military atomic energy program, but also in their peaceful uses program. The peaceful uses of nuclear energy are of considerable political importance throughout the world today, and, therefore, we need to find out exactly what the status of the Soviet nuclear power program is. Any nuclear power program is also going to produce plutonium, which, in turn, can be used for weapons; so knowledge of plutonium production supplies information in the weapons picture as well. Moreover, the Soviets' peaceful program provides an opportunity for personal communication with them. 25X1C

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This peaceful program is a relatively open program [redacted]

Guided Missile Division

The next division, the Guided Missile Division, needless to say, has been very busy. I think I mentioned that we've had to expand our activities in this field.

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Estimate of Soviet Missile Capability to Attack the U.S.: At present the intelligence community estimates that the Soviets had an initial operational capability on 1 January 1960 with a few (say 10) series-produced ICBM's. As is well known, there have been differing views on where the U.S.S.R. will go (in terms of numbers of ICBM's) from that initial capability. The estimates are expressed as a range of numbers, from 140-200 by mid-1961, on launchers. This is the kind of thing that bothers the Office of National Estimates, and reconciliation of different ideas is a problem. It does show that more good information is needed and I can't emphasize this need too much.

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Lack of Intelligence on Production and Deployment: [redacted]

is an extremely rewarding activity and I don't mean to under-estimate its importance, but we still know very little about the details of what goes into these missiles: where they're produced and how they are deployed, despite the fact that we estimate that the missiles are deployed, or at least are operational. Although we're almost positive that all missiles up to a thousand miles range are operational now, we have no *good* evidence of any deployment of these missiles. We have large numbers of 25X1B low-grade rumors and reports, [redacted]

[redacted] Now this is a very serious gap. I might say that deployment is not a responsibility of OSI. The Office of Research and Reports (ORR) follows this more than we do, as do OCI and the military services. OSI is responsible for assessing the state of the Soviet missile art at the time of operational deployment, to include the technical characteristics of the weapon systems, but we look

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to ORR to follow the deployment problem itself. 25X1B

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The Soviet Air Defense System: One of the things that we've been particularly involved in within the last year has been an over-all estimate of the electronic aspects of the Soviet air defense system. Incidentally, it's a very impressive system. It is not a system that is built up of a few lines like our Distant Early Warning (DEW) Line. Their's is, essentially, a solid coverage and everywhere you go in the U.S.S.R. (if you can get information on it) you'll find that there are radars, and they are good radars that have very sophisticated over-all systems. One rather classic example of what you can do in scientific intelligence was done by one person in our shop several years ago. By

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the assessment was pretty sound.



That's a clearcut example of what you can do with a little material, and it doesn't mean that you have to steal the diagrams themselves in order to get very useful scientific intelligence.

Applied Science Division

The title of the last division, the Applied Science Division, is rather a misnomer. The Agency, as you know, is not directly or primarily responsible for intelligence concerning military hardware. Yet, we do have a responsibility for keeping the Director informed of new developments in these fields. The Applied Science Division is responsible for research in those military hardware fields not covered by the other divisions.

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Study of New Developments: We have a small division that keeps track of what's going on in Soviet aircraft and naval developments. This division invests its limited manpower in monitoring the research and development efforts of the Soviet Air Force and Navy as opposed to tactical deployment. We work very closely with the Air Technical Intelligence Center and the Office of Naval Intelligence. Our primary concern is to ensure objective assessments of hardware intelligence.

Biological Warfare and Chemical Warfare: Within this division we also have a small group working on biological warfare (BW) and chemical warfare (CW). Although small, it is probably as big and as active as any of the groups working in the Chemical Corps in the fields of BW and CW. I might say that U.S. BW intelligence is very poor. It's a high priority subject and yet we know very, very little on it. It's very difficult to get at because BW research can be carried on under so many guises. Public health is a perfect cover for BW; you can find out that the Soviets have many people working on diseases but you can't learn which ones are working on BW, or even if anyone is working on BW. We have positive information, however, that they do have a BW program. We believe that we have located their test site, but that's about where it ends.

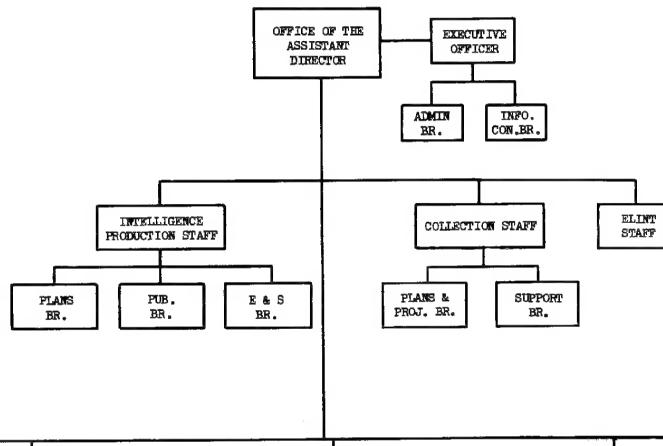
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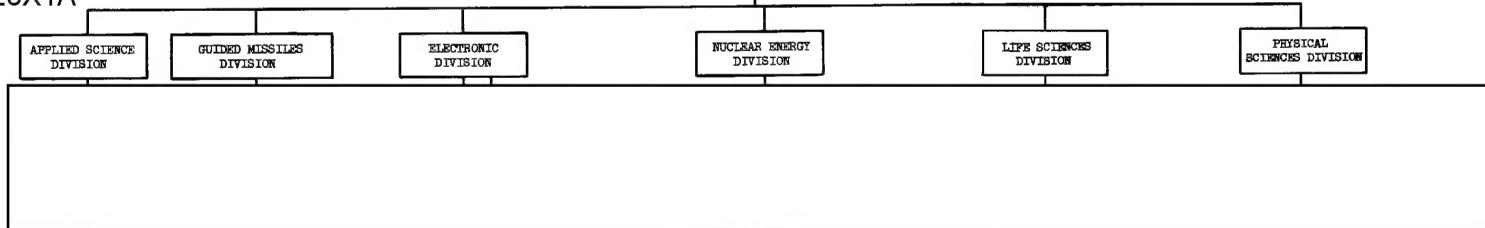
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